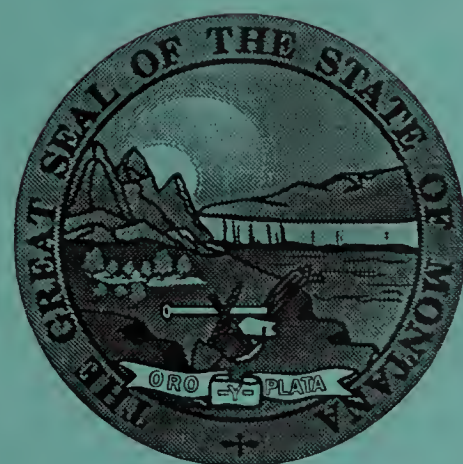




U.S. Department  
of Transportation  
**Federal Highway  
Administration**

**Demonstration Project 85**

# **GIS / Video Imagery Applications**



## **Executive Summary**

**Prepared for:**

**Montana Department of Transportation**

**July 6-7, 1994**

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| 16. Abstract<br><br>This Participant Notebook was developed as a training and reference aid for the GIS/Video Imagery Applications workshop. The workbook is organized to reflect the material presented in this 2-day workshop. The workshop is designed to provide participants with information and an opportunity to discuss, view, and operate GIS and video imagery technology and equipment on the market today. At the completion of this workshop, the participant should have an understanding of: |  |                                                      |                                                    |                                                                                               |  |
| <ul style="list-style-type: none"> <li>- Transportation related applications of GIS and video imagery technologies.</li> <li>- Benefits of integrating GIS and video imagery systems.</li> <li>- Costs, benefits, and potential problems of implementing GIS and video imagery systems.</li> <li>- Role of GIS and video imagery within an Integrated Transportation Information System.</li> </ul>                                                                                                          |  |                                                      |                                                    |                                                                                               |  |
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FHWA  
Demonstration Project 85

# GIS / Video Imagery Applications

## Workshop Instructors

**Simon Lewis**, B.S., M.S. is President and founder of GIS/Trans, Ltd. He has over 15 years experience developing computerized systems and solutions for various transportation agencies and engineering firms. Mr. Lewis has a Civil Engineers degree and an MS in Transportation Engineering from M.I.T. He has taught several GIS courses at M.I.T. prior to setting up GIS/Trans, Ltd. A recognized expert on GIS-T, he has presented papers and instructed workshops at more than 45 GIS-T conferences and events.

**John Sutton**, Ph.D., B.S., Dip. T.P., is Director of Transportation Planning for GIS/Trans, Ltd. He has wide experience in transport studies in the UK, Europe, S.E. Asia and North America. Mr. Sutton is a specialist in transportation planning and modeling, and has led GIS-T projects on ISTEA congestion management, TIGER File clean-up and network conflation. He has instructed several GIS-T workshops for FHWA and at GIS conferences.



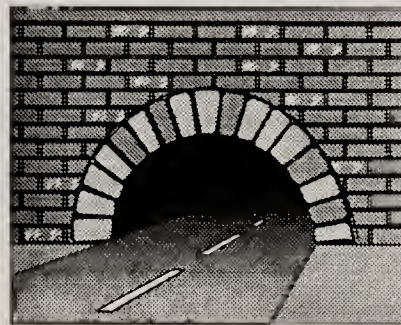
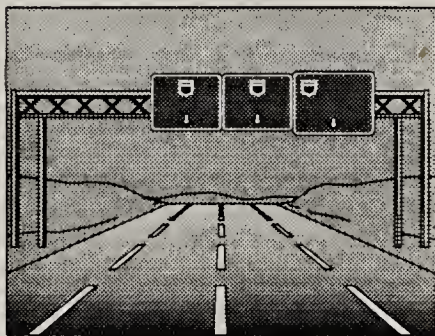
## Acknowledgment

This workbook has been compiled with the assistance of the FHWA Video Imagery Technical Working Group and FHWA GIS and Transportation Technical Working Group. Assistance was also provided by various individuals of FHWA, Connecticut DOT, and Mandli Communications, and by David Fletcher.





# Integrated Transportation Information Systems (ITIS)





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# ITIS Overview

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- Integrated Transportation Information Systems
  - Information is a corporate resource
  - Modern Information System practice is to integrate systems, as well as data
  - ISTEA embodies philosophy of integrated systems
  - GIS and videolog: seen within a data and application integration framework



# 1990s: Changing Environment

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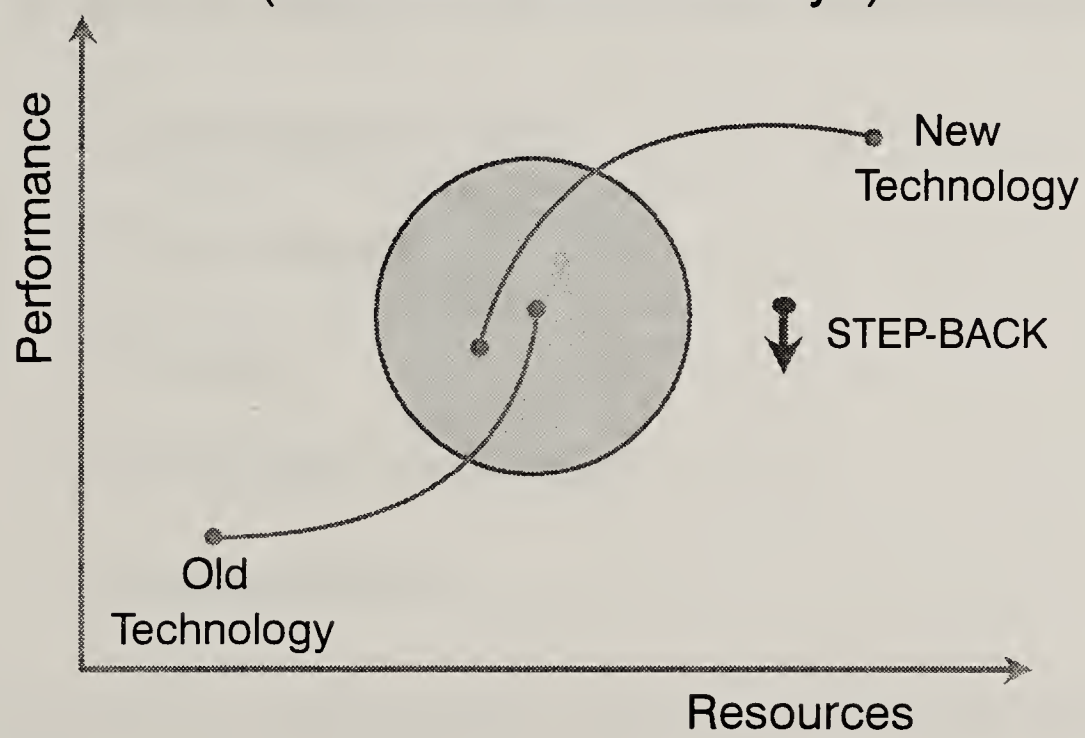
| TOPIC                                   | CHANGE                                                                              |
|-----------------------------------------|-------------------------------------------------------------------------------------|
| Role and Focus                          | Construction → Maintenance                                                          |
| Computer Technology                     | "Mainframe shops" → Distributed, Open Systems                                       |
| Reporting: Federal & Local Requirements | Lower → Higher (ISTEA)                                                              |
| Staff                                   | Good field experience → Newer, lower nos., computer literate, less field experience |



# Foster's S Curve

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(There is a "discontinuity"!)



- Performance down, resources up, for transition



# The DOT Challenge

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- To take a wider systems view, that integrates:
  - Corporate needs
  - Technology
  - People
  - Available resources
  - Applications
- GIS and Videolog two types of key technical tools within this framework



# Information System Architecture

## Wider Systems View

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- Models of the business from multiple perspectives:

- Data (what)



- Functional (how)



- Network (where)



- Organizational (who)



- Event (when)



Source: DP85 and FHWA IHIS/GIS Symposium



# Information Engineering

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- A formal method used to:
  - Identify and manage the business-functions information used in a business
  - Create and manage a business' Information Systems Architecture
  - Right information, available to the right people, at the right time, in the right place

Source: DP85 and FHWA IHIS/GIS Symposium

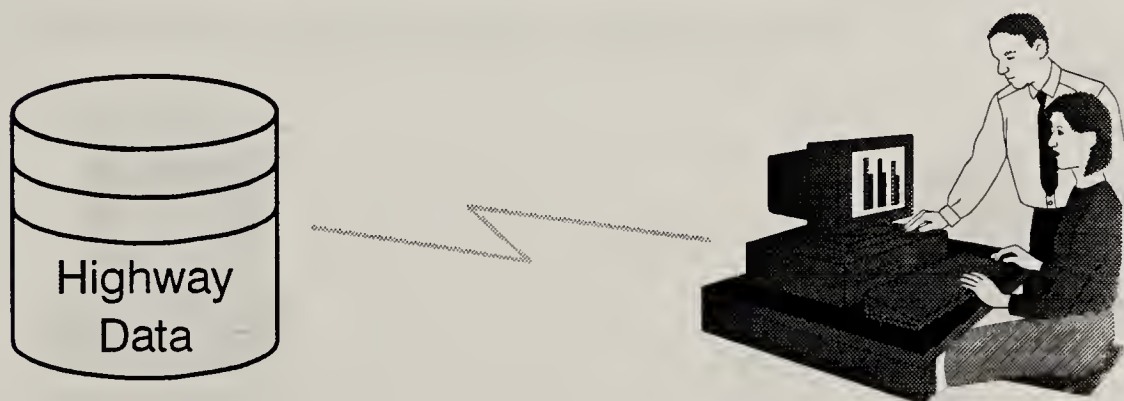


# Highway Information System

(H.I.S.)

---

A computerized system enabling the collection, storage, and use of highway related data



Source: DP85 and FHWA IHIS/GIS Symposium



# Integrated Transportation Information System

## (I.T.I.S.)

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- The combination of all highway and transit related information systems
- Developed as a result of an information system architecture analysis, using the principles and methods of information engineering



Source: DP85 and FHWA IHIS/GIS Symposium



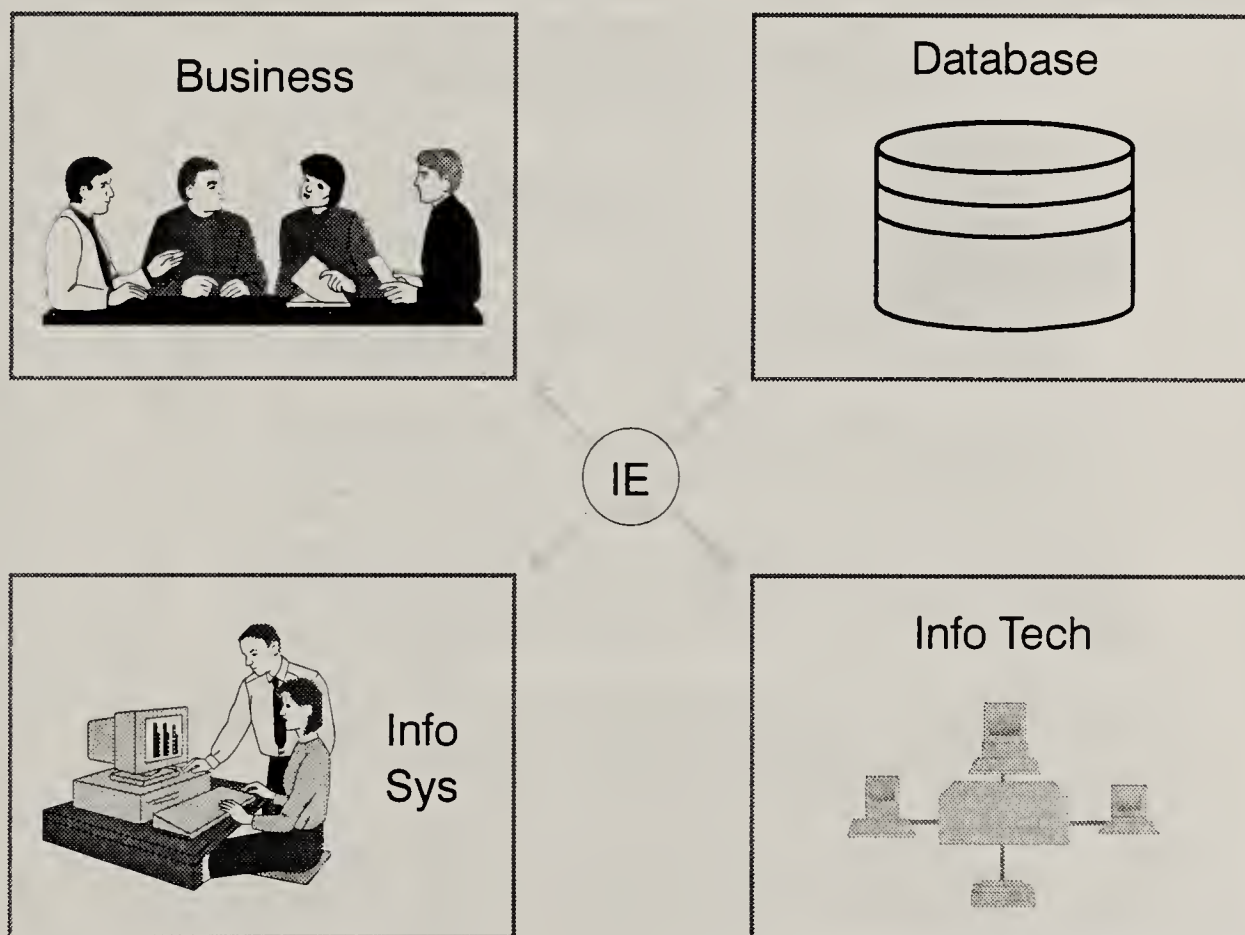
# ITIS Framework

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- ITIS : People and information technology working together to improve transportation solutions
- This implies at least three kinds of integration:
  - Institutional
  - Process or Information Flow
  - Technological



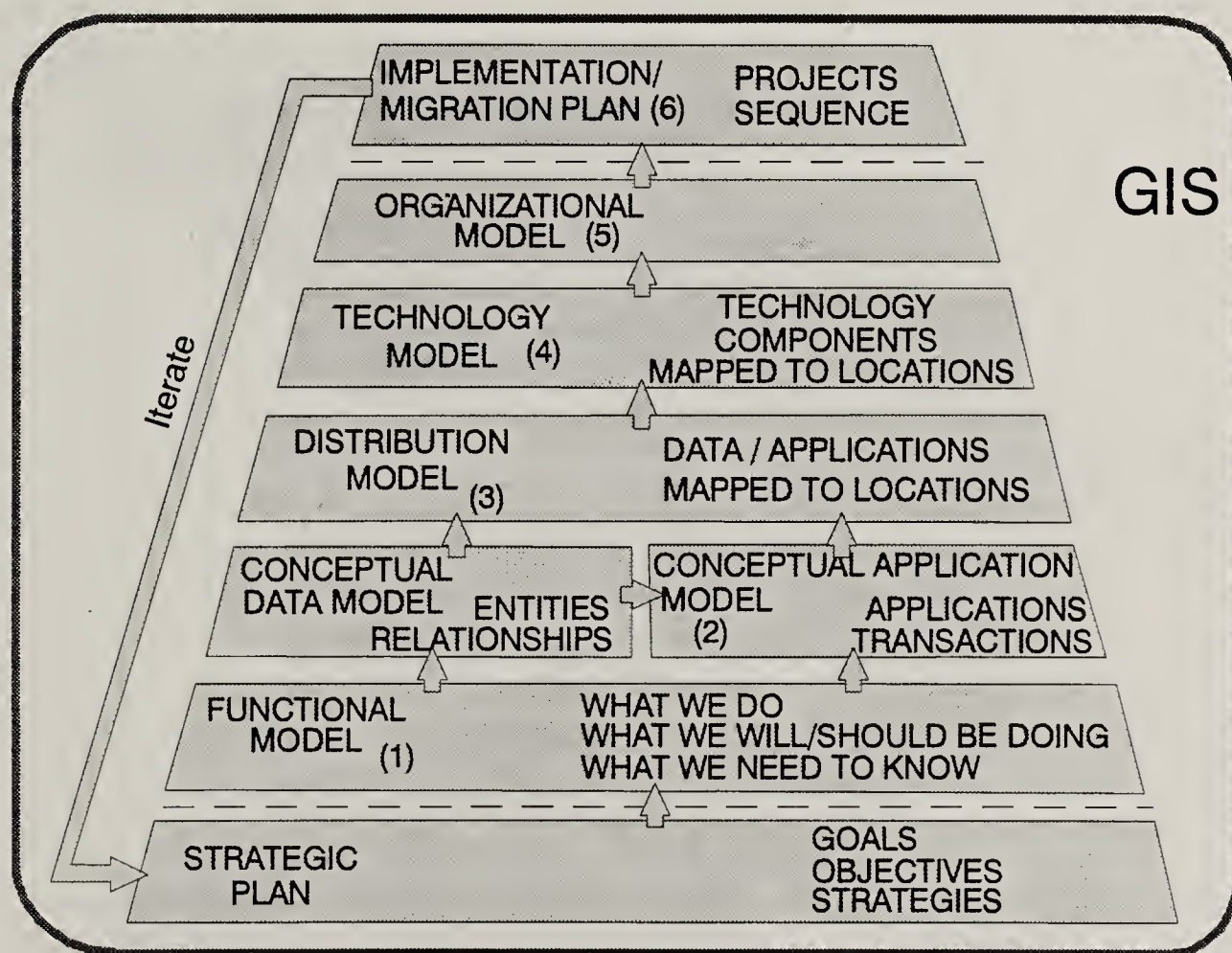
# ITIS Framework



Source: Geo/digm



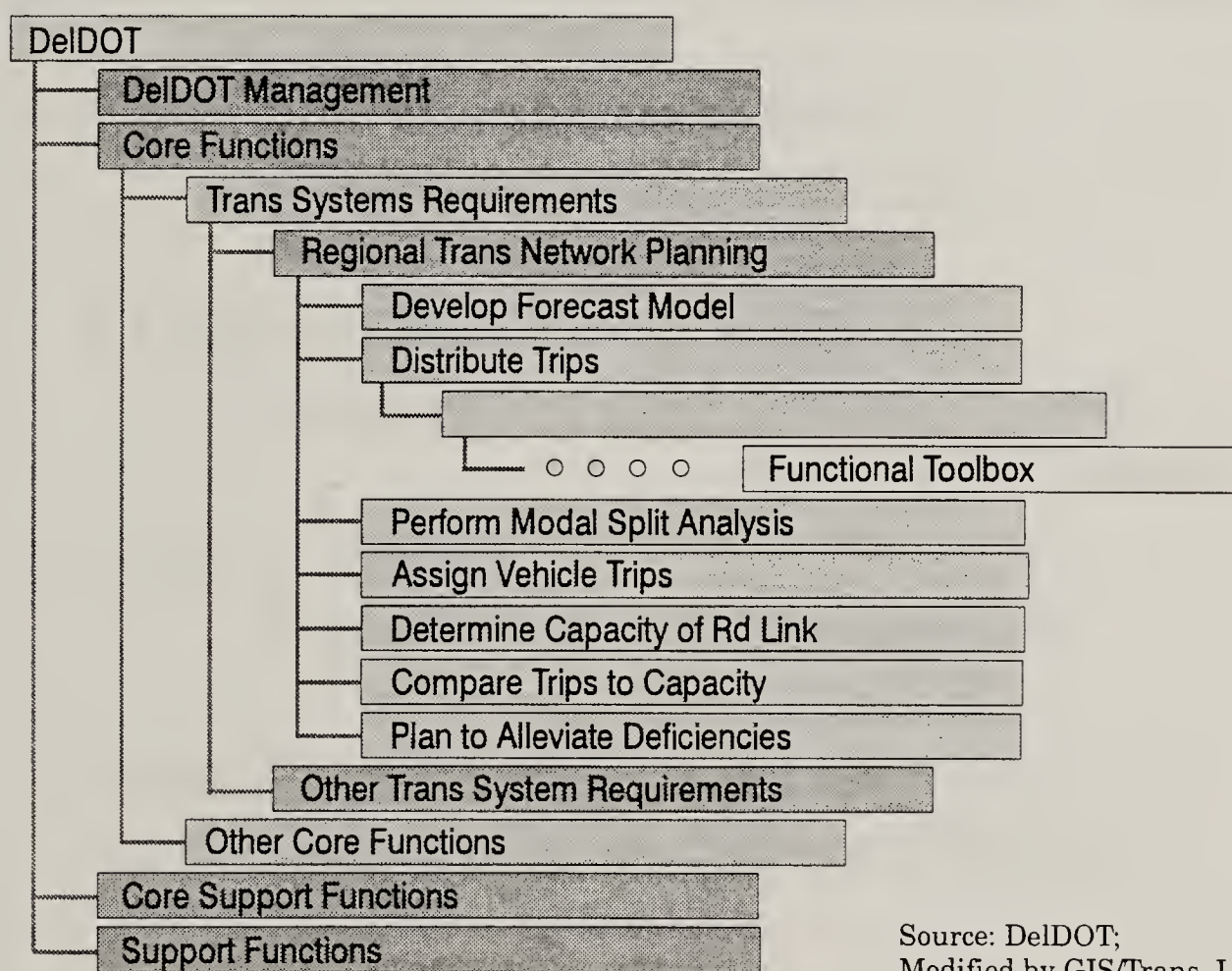
# DOT Information Resource Management: Models & Plan



Source: DelDOT; Modified by GIS/Trans, Ltd.



# Functional Hierarchy



Source: DeIDOT;  
Modified by GIS/Trans, Ltd.



# ITIS Fundamentals - I

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- Transportation data objects
  - Selection of road network
- Location Reference Systems
  - Selection of segmentation, LRS
- GIS-T toolbox
  - Selection of software vendor
- Database Management Systems
  - Selection of corporate DBMS



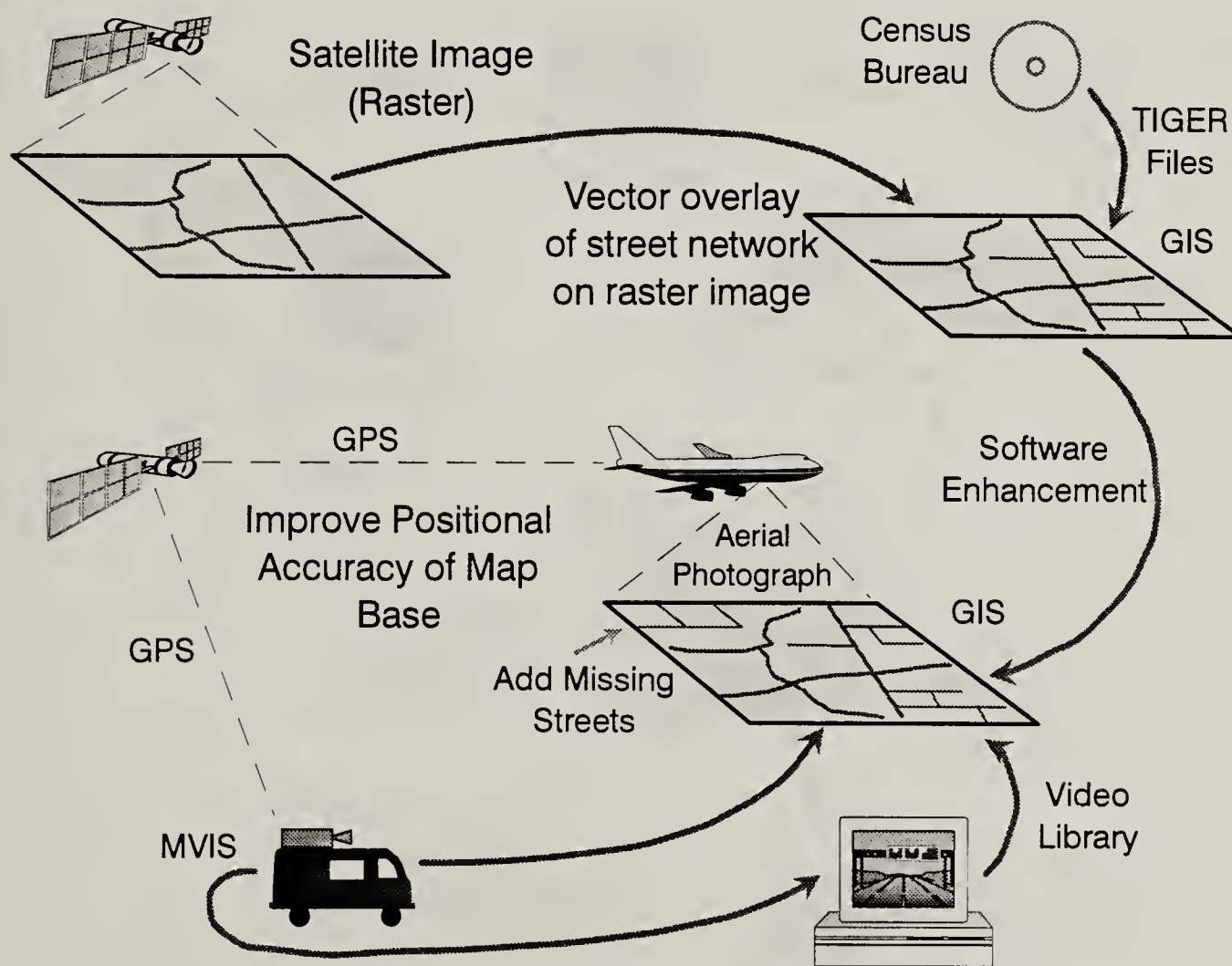
## ITIS Fundamentals - II

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- The overwhelming amount of data necessary for transport assessment is location based
- Transportation location can be described geodetically, geographically, or linearly
- Location can be used as both a logical and physical data index or key
- Location can be used to integrate multiple disparate data sets (data infusion)
- Location can be used for specific analytical purposes (e.g., routing, proximity)
- Need to review use of location referencing systems

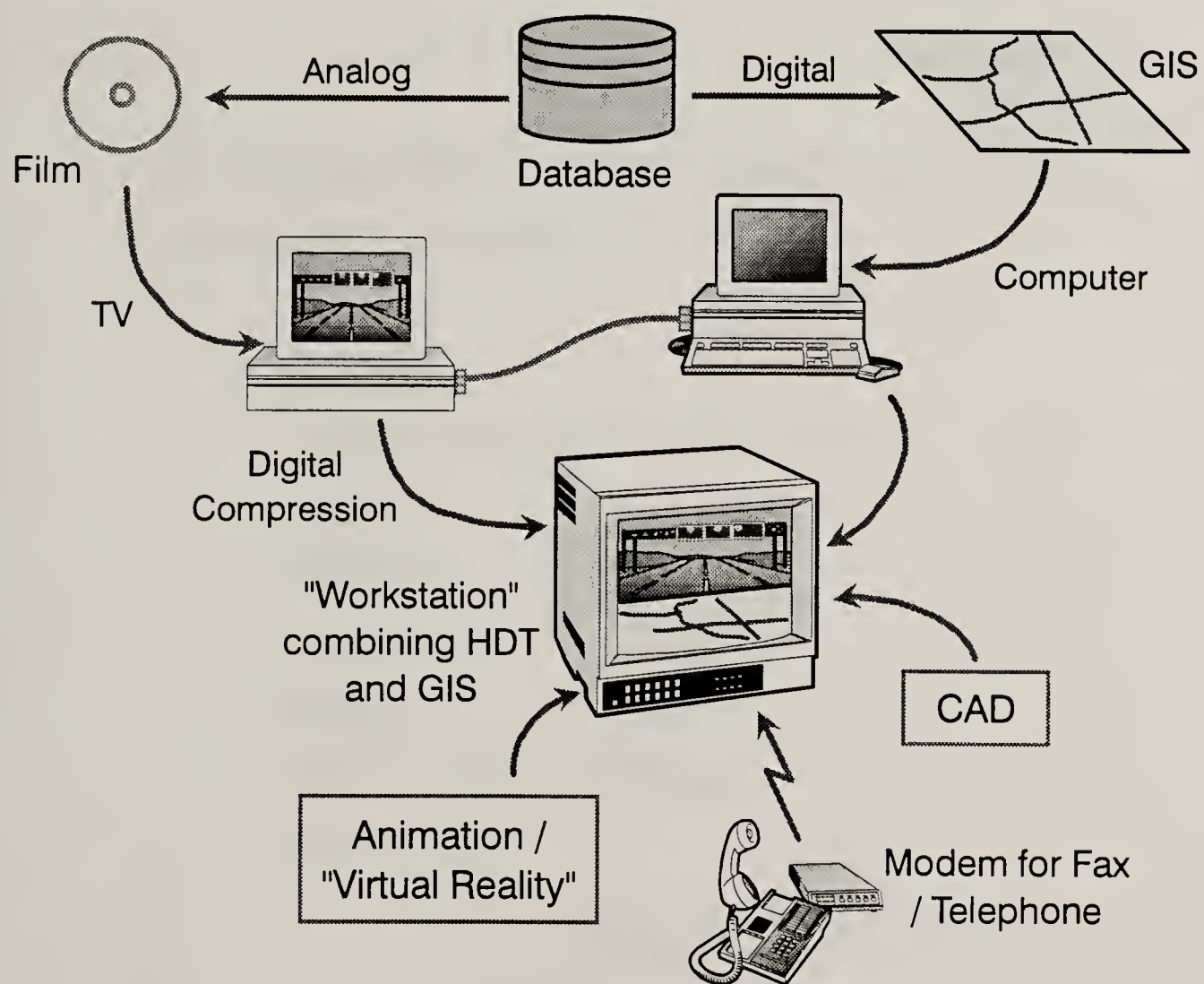


# Multimedia Integration I





## Multimedia Integration II





## ITIS Fundamentals - III

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- Transportation data objects at these locations can be:
  - Spatial
  - Alpha-numeric (tabular)
  - Image
  - Video
  - Graphic
  - Audio
  - Temporal (archive)
  - Complex

Source: Alliance for Transportation Research,  
"Geographic and Transportation Computing Concept"



## ITIS Fundamentals - IV

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- The collection of technologies developed to process location data is generically referred to as a:

GIS (Geographic Information System)

- Extensions to the basic GIS model to better recognize networks and linear objects (i.e., routes) have resulted in:

GIS-T (GIS for Transportation)



# ITIS Fundamentals - V

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- GIS-T basic functions/services can be described as:
  - Data acquisition (digitizing, scanning)
  - Data management (RDBMS, object-oriented databases)
  - Data fusion (network overlays)
  - Data analysis (shortest path, traffic assignment, school bus routing)
  - Data visualization (map display)
  - Data dissemination (data translation and conversion)

Source: Alliance for Transportation Research,  
"Geographic and Transportation Computing Concept"



# ITIS Fundamentals - VI

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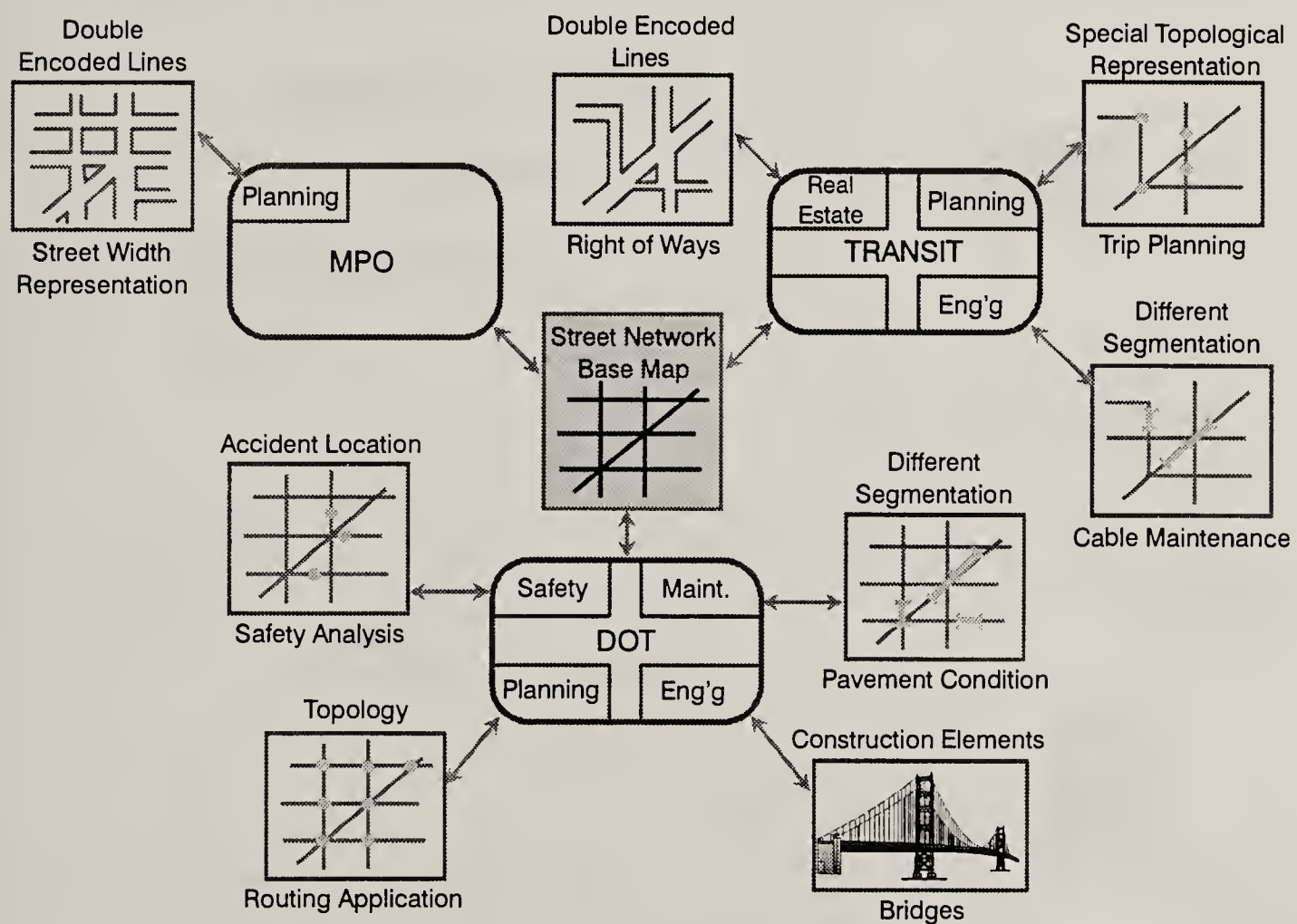
ITIS is a management vision of a new framework for doing business

GIS-T is a technology vision of the same framework

- Neither can be achieved without the other
- GIS-T is therefore a critical strategic decision with major implications for how the organization does business
- The application of these services to specific transport activities results in new applications for doing business

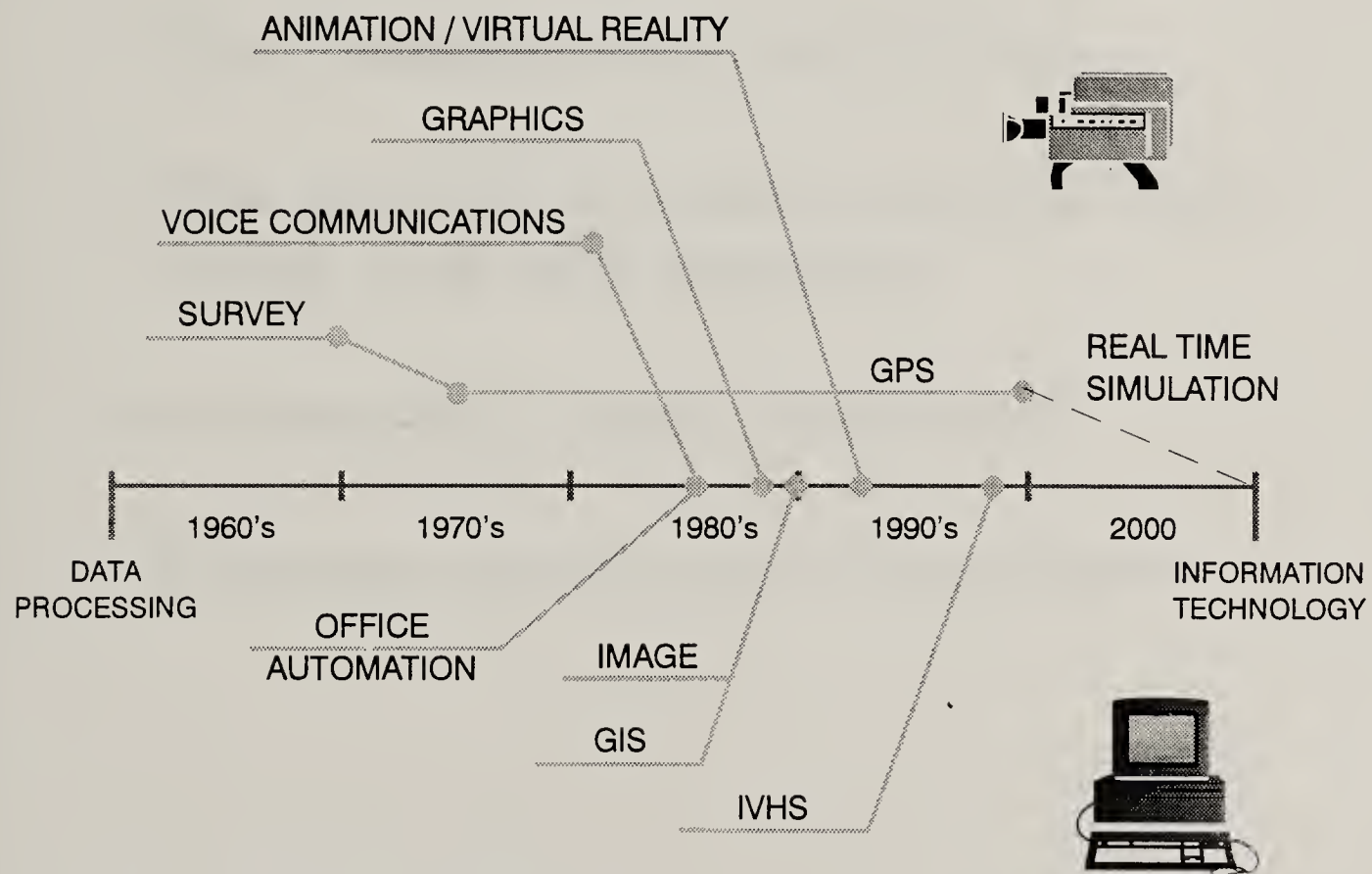


# ITIS: Difference in Representation Requirements Between Departments & Between Agencies





# Technology Integration



Source: FHWA IHIS/GIS International Symposium



# GIS-T

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- Was "bleading edge" technology
- Now in production use in several DOTs, FHWA, and other agencies
- Further being rapidly developed
- Database development is key issue



# ITIS Benefits

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- Better Information
  - (e.g., North Carolina)
- Higher Productivity
  - (e.g., Wisconsin DOT PMS)
- Quality Products
  - (e.g., FHWA maps)
- Improved Workforce
  - (e.g., City of Edmonton)
- Improved Return on Investment
  - (e.g., Los Angeles County)



# ITIS

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- NO single solution
- On-going evolutionary process
- Unique combination of your organization plus your technology
- Statement of vision and direction

Source: FHWA IHIS/GIS International Symposium



# Implementation Planning Issues

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- Information System Plan
- Staffing (Management)
- Financial
- GIS and data update and maintenance
- Feasibility study
- Pilot project
- Coordinating with other agencies
- Staff preparation and training
- RFP process
- Working with consultants





# GIS Support Group Placement

- A Key Issue -

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Three main options:

- Executive Level
- Support Group
- Operational Unit



*Pros / Cons?*



# The Challenge and The Opportunity

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- Early GIS-T efforts not a good success record
- Seeing a greater level of success
- Due to effort being part of a wider systems, corporate-level effort
- Benefits of integrating systems
  - Less duplications
  - Better decision support





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